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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
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| 09/782,558      | 02/13/2001  | Carlo Rubbia         | P-6150              | 9660             |

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EXAMINER

PALABRICA, RICARDO J

ART UNIT

PAPER NUMBER

3641

DATE MAILED: 05/07/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

|                            |                  |
|----------------------------|------------------|
| Application No.            | RUBBIA, CARLO    |
| Examiner<br>Rick Palabrida | Art Unit<br>3641 |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address. --  
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1) Responsive to communication(s) filed on 24 March 2003.

2a) This action is FINAL.                    2b) This action is non-final.

3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4) Claim(s) 25-45,47-70,72 and 73 is/are pending in the application.

4a) Of the above claim(s) 30,31,35,51,56 and 57 is/are withdrawn from consideration.

5) Claim(s) \_\_\_\_\_ is/are allowed.

6) Claim(s) 25-29,32-34,36-45,47-50,52-55,58-70 and 73 is/are rejected.

7) Claim(s) \_\_\_\_\_ is/are objected to.

8) Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

9) The specification is objected to by the Examiner.

10) The drawing(s) filed on \_\_\_\_\_ is/are: a) accepted or b) objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11) The proposed drawing correction filed on \_\_\_\_\_ is: a) approved b) disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12) The oath or declaration is objected to by the Examiner.

**Priority under 35 U.S.C. §§ 119 and 120**

13) Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a) All b) Some \* c) None of:

1. Certified copies of the priority documents have been received.
2. Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

14) Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) The translation of the foreign language provisional application has been received.

15) Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

**Attachment(s)**

1) Notice of References Cited (PTO-892)

2) Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_\_.

4) Interview Summary (PTO-413) Paper No(s) \_\_\_\_\_.

5) Notice of Informal Patent Application (PTO-152)

6) Other: \_\_\_\_\_

## **DETAILED ACTION**

1. Applicant's Request for Continued Examination in Paper No. 21 and amendment B is Paper No. 22 that includes a revision of independent claims 25 and 49, are acknowledged.

Applicant also alleges that the revision of said claims to include the limitation of a fissile material coating "arranged to expose the fissile material to a neutron flux for inducing fission and the release of fission fragments into the chamber to interact with the gas circulating through the chamber" would define over prior art. The examiner disagrees because this feature is a statement of desired use that would not patentably distinguish the claimed apparatus over that of the reference. Details are provided below.

### ***Claim Rejections - 35 USC § 112***

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claims 25-29, 32-34, 36-45, 47-50, 52-55, 58-70, and 73 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claims contain subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

Independent claims 25 and 49 recite the limitation “wall having a front face coated with fissile material arranged to expose the fissile material to a neutron flux for inducing fission and the release of fission fragments into the chamber to interact with the gas circulating through that chamber.” There is neither an adequate description disclosure nor enabling disclosure as to how and in what manner having a front face coated with fissile material **alone** (i.e., without consideration of thickness or porosity factors) would ensure release of fission fragments into the chamber.

The claims refer to coated front face as “arranged to expose the fissile material to a neutron flux.” It is unclear what is meant by the term “arranged”. There is also neither an adequate description nor enabling disclosure as to what is the source of this so-called “neutron flux”. The claim language implies a neutron source that is separate from the fissile material because this material is recited as being exposed to the neutron flux.

3. Claims 25-29, 32-34, 36-45, 47-50, 52-55, 58-70, and 73 are rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

In Paper No. 15, claims 25 and 49 only disclose a device comprising “chamber containing gas.” In Paper No. 22, new elements to the device have been introduced, i.e., “inlet means for introducing gas into the chamber” and “outlet means for evacuating gas circulated through said chamber.”

In Paper No. 15, claims 25 and 49 only disclose a wall coated with fissile material on a front face and fissions in the fissile material release fission fragments into the chamber. In Paper No. 22, this limitation has been changed to the coated wall being arranged such that fission fragments are not only released but they also interact with the gas in the chamber.

4. Claims 25-29, 32-34, 36-45, 47-50, 52-55, 58-70, and 73 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Independent claims 25 and 49 recite the limitations "wall having a front face coated with fissile material arranged to expose the fissile material to a neutron flux for inducing fission and the release of fission fragments into the chamber to interact with the gas circulating through that chamber."

The statement, "arranged to expose the fissile material to a neutron flux for inducing fission and the release of fission fragments into the chamber to interact with the gas circulating through that chamber", does not inherently follow from the actual structure recited, i.e., "wall having a front face coated with fissile material". The claim language inappropriately implies that any coating of fissile material, regardless of its thickness or porosity characteristics, would result in the release of fission fragments into the chamber. Thus, the claims are vague, indefinite and incomplete because there is a missing critical element.

***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

5. Claims 25-27 and 32 are rejected under 35 U.S.C. 102(b) as being anticipated by either one of McArthur et al. (U.S. 3,952,263) or Eerkens (U.S. 3,391,281).

McArthur et al. disclose in Fig. 1 a fission fragment excited laser system in Fig. 1, comprising at least one open chamber having a wall (12), inlet means for introducing gas into the chamber (39), outlet means for evacuating the gas, the wall having a front face coated with fissile material (26, 28), a rear face with means to cool it (36), and a neutron reflector (42). The fissile material comprises uranium 235 with a thickness of approximately 8 mg/cm<sup>2</sup> (density of 8.3 gm/ cm<sup>3</sup> multiplied by linear thickness of 10<sup>-3</sup> cm). See column 5, lines 35+.

Eerkens disclose a direct nuclear radiation excited photon generator and emitter. The claims read on the embodiment shown in Fig. 7. Note in the figure that canister 96 (which contain the gas excited by fission fragments) is placed in the core of a reactor. The reactor inherently has a means to cool the outer surface of the canister, in the same manner that fuel assemblies in a reactor core are cooled. Said outer surface reads on the claim language "rear face."

***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claims 25, 26, 28, 29, 32, 33, 36-45, 47-50, 52, 54, 55, 58, 59, 61-64, and 67-70 are rejected under 35 U.S.C. 103(a) as being unpatentable over Culver (U.S. 5,873,239) in view of Bingham et. al (U.S. 4,759,911). Culver discloses the applicant's claims except for the fissile material-coated chamber.

Culver discloses a nuclear rocket engine comprising a gas heating device (Fig. 1) including at least one chamber for containing gas, i.e., hollow fuel assembly (48), means for cooling the rear face of the chamber (see coolant flow on the outer surface of fuel assembly, and a means for expelling the heated gas into space to generate thrust (see nozzle 10). Culver further discloses (see Fig. 4) a neutron reflector (52) surrounding the enclosure of the gas heating device, said reflector having cavities for receiving removable neutron-absorbing control rods (see numeral 76 and column 5, lines 55+). Culver uses a gaseous hydrogen propellant (see column 8, lines 65+) and beryllium reflector (see column 5, lines 58+). Culver further discloses a chamber cooling circuit that is separate from the propellant circuit, said "means for cooling the chamber" as being located at a "rear face" of said chamber (e.g., numeral 34, Fig. 2).

Culver does not disclose details about the fuel assemblies and moderator, but teaches that they are of conventional construction (see column 4, lines 60+). Bingham et. al disclose a gas-cooled fuel element for space power and propulsion applications (see column 1, lines 10+). Bingham et. al show this fuel element in their figure as a cylinder wherein americium carbide is coated on the cylinder base material (see column 2, lines 40+).

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the nuclear rocket, as disclosed by Culver, by the teaching of Bingham et. al, in order to have a space engine, comprising least one chamber has a coating of americium carbide fissile material on a front face, as this no more than the use of a well-known fuel material and configuration in the nuclear rocket art.

Note that the claim limitation "arranged to expose the fissile material to a neutron flux for inducing fission and the release of fission fragments into the chamber to interact with the gas circulating through that chamber" is a statement of desired use. This statement does not serve to patently distinguish the claimed structure over that of the reference, as long as the structure is capable of performing the intended use. See MPEP 2111-2115.

The claimed structure is a front face coated with fissile material, which is the same structure as in the Culver-Bingham et al. combination. This combination is also exposed to a neutron flux and therefore it is capable of producing fission fragments that can be release into the chamber to interact with the gas.

See also MPEP 2114 that states:

A claim containing a "recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus" if the prior art apparatus teaches all the structural limitations of the claim. Ex parte Masham, 2 USPQ2d 1647.

Claims directed to apparatus must be distinguished from the prior art in terms of structure rather than function. In re Danly, 263 F.2d 844, 847, 120 USPQ 528, 531.

[A]pparatus claims cover what a device is, not what a device does."  
Hewlett-Packard Co. v. Bausch & Lomb Inc., 15 USPQ2d 1525,1528.

As set forth in MPEP 2115, a recitation in a claim to the material or article worked upon does not serve to limit an apparatus claim.

7. Claims 27, 34, 53 and 60 are rejected under 35 U.S.C. 103(a) as being unpatentable over the Culver - Bingham et. al combination, as applied to claims 25, 26, 28, 29, 32, 33, 36-45, 47-50, 52, 54, 55, 58, 59, 61-64, and 67-70 and further in view of IDS document C2, Chikin et al. "Gas Heating by Fission Fragments in the Channel of a Pulsed Reactor," Atomnaya Energiya, December 1988, USSR, Vol. 65, No. 6) and Etherington (Nuclear Engineering Handbook). The combination as discussed above in section 6 discloses the applicant's inventive concept except for the specifics on the thickness of the fissile material and the reflector.

As to the limitation in said claims of having a fissile content of lower than 10 mg/cm<sup>3</sup>, Chikin discloses a gas-filled channel of a pulsed reactor wherein a layer of highly enriched nuclear fuel (90% <sup>235</sup>U) of thickness 2.5 microns is applied to the inner surface of the graphite wall of said channel. Fission fragments from said fuel heat the gas similar to the claimed inventive concept. Based on a density of uranium = 19 gm/cm<sup>3</sup>

(e.g., see H. Etherington, Nuclear Engineering Handbook), the thickness of the nuclear fuel is equivalent to 4.7 mg/cm<sup>3</sup>.

As to the limitation regarding the reflector having a thickness of at least 50/d, where d = density of carbon material, this yields a thickness of at least 22 cm, based on a graphite density of 2.22 gm/ cm<sup>3</sup>. Etherington teaches that graphite has a thermal diffusion length = 51.8 cm (see Table 24, page 1-20). As stated by the Examiner in the 4/17/02 Office Action, it is well known in the nuclear art that a reflector should have a thickness of at least one thermal diffusion length in order to be effective, and to use a 51.8 cm thickness for the graphite reflector would have been *prima facie* obvious.

Modification of any one of the cited combinations to have included the teachings of Childin and Etherington would have been obvious to one having ordinary skill in the art at the time the invention was made, as such results are in no more than utilization of known techniques in the nuclear art.

8. Claims 65, 66, 72 and 73 are rejected under 35 U.S.C. 103(a) as being unpatentable over the Culver - Bingham et. al combination, as applied to claims 25, 26, 28, 29, 32, 33, 36-45, 47-50, 52, 54, 55, 58, 59, 61-64, and 67-70

As stated by the Examiner in the 4/17/02 Office Action, the limitation in said claims regarding the use of <sup>7</sup>Li as coolant is a well-known expedient in the nuclear art because of its good heat-absorbing capacity and its low molecular weight, and so to use <sup>7</sup>Li as a substitute coolant for hydrogen in the Culver - Bingham et. al combination would be *prima facie* obvious.

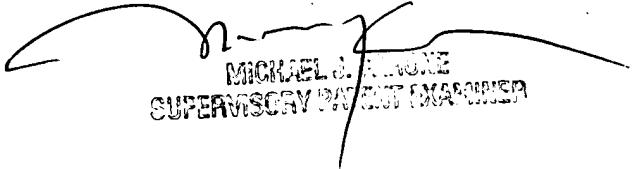
***Conclusion***

9. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Reference C further illustrates prior art..
  
10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Rick Palabrida whose telephone number is 703-306-5756. The examiner can normally be reached on 7:00-4:30, Mon-Fri; 1st Friday off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Carone can be reached on 703-306-4198. The fax phone numbers for the organization where this application or proceeding is assigned are 703-305-7687 for regular communications and 703-305-7687 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-1113.

RJP  
May 1, 2003

  
MICHAEL J. CARONE  
SUPERVISORY PATENT EXAMINER